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**SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)**

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**FIRST SEMESTER M.TECH DEGREE EXAMINATION (Regular), DECEMBER 2022****COMPUTER SCIENCE AND SYSTEMS ENGINEERING****(2021 Scheme)****Course Code: 21SE102****Course Name: Advanced Algorithmic Concepts****Max. Marks: 60****Duration: 3 Hours****PART A****(Answer all questions. Each question carries 3 marks)**

1. Solve the following recurrence relation using iteration method.  

$$T(n) = 2(n/2) + 3n^2$$

$$T(1) = 1$$
2. Find the amortized cost using Accounting/Taxation method for MULTIPOP( ) operation in stack data structure.
3. Compute the prefix function for the pattern *abcdabca* when the alphabet is  $\Sigma = \{a,b,c,d\}$ .
4. Explain Dinic's method for finding flow in a network with the help of an example.
5. Consider 5 items along their respective weights (*w*) and values (*v*)  
 $i = (I1, I2, I3, I4, I5)$   
 $w = (5, 10, 20, 30, 40)$   
 $v = (30, 20, 100, 90, 160)$   
 The capacity of knapsack  $W=60$ . Find the solution to the fractional knapsack problem using greedy strategy.
6. Write a short notes on NP Complete problems. Explain SAT problem.
7. Define spanning tree of a graph. Write the total number of spanning trees possible for a complete graph with 4 vertices.
8. What are the characteristics required by problems so that they can be solved by dynamic programming approach?

**PART B****(Answer one full question from each module, each question carries 6 marks)****MODULE I**

9. a) Solve the recurrence relation using master method  $T(n) = 3T(n/4) + n \log n$  (3)
- b) Solve the recurrence relation by changing variable  $T(n) = 2T(\sqrt{n}) + 1$  (3)

**OR**

- 10. a) Explain the proof of master theorem. (3)
- b) Solve the recurrence relation using iteration method (3)  
 $T(n) = 2T(n/2) + 3n^2$ .

**MODULE II**

- 11. a) Explain Rabin-Karp algorithm ? Illustrate the Rabin Karp algorithm for the text : 3141592653589793 Pattern: 26 assign  $q=11$ . (3)
- b) Show the result of inserting the following items in an initially empty B-tree of order =5 (3)  
 25,31,38,76,5,60,38,8,30,15,35.

**OR**

- 12. a) Draw the binomial heap for the data ( 7,2,4,17,1,11,6,15,10,20 ). (3)  
 Also extract the node with the minimum key two times.
- b) Explain KMP algorithm with the help of Text : *abxabcabcaby* (3)  
 Pattern: *abcaby*

**MODULE III**

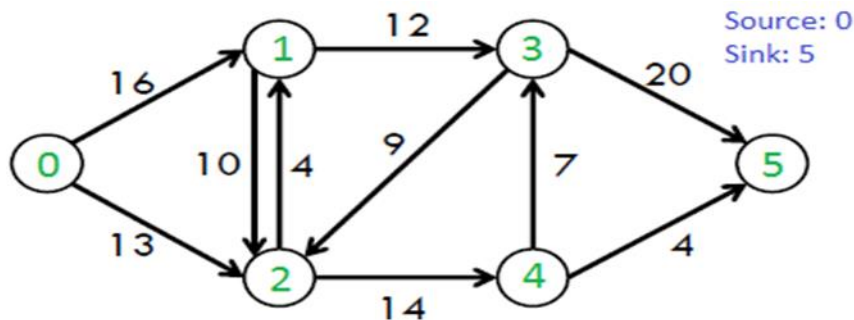
- 13. a) Explain how topological sorting can be performed using depth first search. (3)
- b) Write Dijkstra’s Single Source Shortest path algorithm and illustrate with example. (3)

**OR**

- 14. a) What are strongly connected components in a graph? (3)
- b) Explain Bellman Ford algorithm. Will your algorithm detect all negative cycles in the graph? Justify your answer. (3)

**MODULE IV**

- 15. Show the execution of Edmond Karp algorithm .Find the minimum cut and the maximum flow across the cut . Also find the capacity of the cut. (6)



**OR**

- 16. a) Draw a flow network, consider a cut and find the flow across the cut and the capacity of the cut. (3)

- b) The value of any flow in a flow network  $G$  is bounded from above (3)  
by the capacity of any cut of  $G$ . Prove.

**MODULE V**

17. If  $G = (V, E)$  is an undirected graph, then the graphic matroid  $M_G = (S_G, I_G)$  is a matroid. ( $S_G$  is the edge set of  $G$  and if  $A \subseteq E$ , then  $A \in I_G$  iff  $A$  is acyclic). (6)

**OR**

18. What is greedy strategy? Also explain optimal substructure property and greedy choice property. (6)

**MODULE VI**

19. Prove that Vertex cover problem is NP Complete (6)

**OR**

20. Prove that 3SAT problem is NP Complete (6)

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